

What is claimed is:

- 1 1. A mesh generating method for use in a semiconductor
- 2 process simulation or a semiconductor device simulation and for
- 3 achieving an optimum placement of a mesh, comprising:
- 4 a mesh point initial placement step of placing initially
- 5 mesh points;
- 6 an evaluation function calculating step of calculating a
- 7 value, corresponding to a placement pattern, of a specified
- 8 evaluation function taking on a specified value corresponding to
- 9 a placement pattern of said mesh points and being used as an index
- 10 for implementing an optimum placement of said mesh points;
- 11 a random number generating step of generating a random
- 12 number;
- 13 a re-placement evaluation function calculating step of
- 14 calculating a value of said evaluation function to be obtained
- 15 when each of specified mesh points is moved to a position
- 16 corresponding to said random number generated in said random
- 17 number generating step;
- 18 a well-posed placement possibility judging step of judging
- 19 a well-posed placement possibility in movement of said specified
- 20 mesh points based on values of said evaluation function calculated
- 21 in said evaluation function calculating step and on values of said
- 22 evaluation function calculated in said re-placement evaluation
- 23 function calculating step; and
- 24 a mesh point re-placement step of performing re-placement
- 25 of said mesh points by moving said specified mesh points when said
- 26 well-posed placement possibility is judged to exist in said
- 27 well-posed placement possibility judging step.

1 2. A mesh generating method for use in a semiconductor
2 process simulation or a semiconductor device simulation and for
3 achieving an optimum placement of a mesh, comprising:

4 a mesh point initial placement step of placing initially
5 mesh points;

6 an evaluation function calculating step of calculating a
7 value, corresponding to a placement pattern, of a specified
8 evaluation function taking on a specified value corresponding to
9 a placement pattern of said mesh points and being used as an index
10 for implementing an optimum placement of said mesh points;

11 a re-placement evaluation function calculating step of
12 calculating a value of said evaluation function obtained when each
13 of specified mesh points is moved to a specified position in
14 direction in which said evaluation function becomes an extreme
15 value corresponding to re-placement which brings said mesh points
16 nearly to a state in which an optimum placement is achieved;

17 a well-posed placement possibility judging step of judging
18 a well-posed placement possibility in movement in said specified
19 mesh points based on values of said evaluation function calculated
20 in said evaluation function calculating step and on values of said
21 evaluation function calculated in said re-placement evaluation
22 function calculating step; and

23 a mesh point re-placement step of performing re-placement
24 of said mesh points by moving said specified mesh points when said
25 well-posed placement possibility is judged to exist in said
26 well-posed placement possibility judging step.

1 3. A mesh generating method for use in a semiconductor
2 process simulation or a semiconductor device simulation and for

3 achieving an optimum placement of a mesh, comprising:

4 a mesh point initial placement step of placing initially
5 mesh points;

6 an evaluation function calculating step of calculating a
7 value, corresponding to a placement pattern, of a specified
8 evaluation function taking on a specified value corresponding to
9 a placement pattern of said mesh points and being used as an index
10 for implementing an optimum placement of said mesh points;

11 a re-placement evaluation function calculating step of
12 calculating a value of said evaluation function to be obtained
13 when each of specified mesh points is deleted; and

14 a well-posed placement possibility judging step of judging
15 a well-posed placement possibility in deletion of said specified
16 mesh points based on values of said evaluation function calculated
17 in said evaluation function calculating step and on values of said
18 evaluation function calculated in said re-placement evaluation
19 function calculating step; and

20 a mesh point re-placement step of performing re-placement
21 of said mesh points by deleting said specified mesh points when
22 said well-posed placement possibility is judged to exist in said
23 well-posed placement possibility judging step.

1 4. A mesh generating method for use in a semiconductor
2 process simulation or a semiconductor device simulation and for
3 achieving an optimum placement of a mesh, comprising:

4 a mesh point initial placement step of placing initially
5 mesh points;

6 an evaluation function calculating step of calculating a
7 value, corresponding to a placement pattern, of first and second

8 evaluation functions taking on a specified value corresponding
9 to a placement pattern of said mesh points and being used as an
10 index for implementing an optimum placement of said mesh points;
11 a first random generating step to generate a first random
12 number;
13 a second random generating step to generate a second random
14 number;
15 a first re-placement evaluation function calculating step
16 of calculating a value of said first evaluation function obtained
17 when each of specified mesh points is moved in a first probability
18 based on said first random number to a position corresponding to
19 said second random number generated in said second random number
20 generating step;
21 a second re-placement evaluation function calculating step
22 of calculating a value of said second evaluation function obtained
23 when each of said specified mesh points is moved in a second
24 probability based on said first random number to a specified
25 position in a direction in which said second evaluation function
26 becomes an extreme value corresponding to re-placement which
27 brings said mesh points nearly to a state in which an optimum
28 placement is achieved;
29 a well-posed placement possibility judging step of judging
30 a well-posed placement possibility in movement of said specified
31 mesh points based on a value of said first or second evaluation
32 function calculated in said evaluation function calculating step
33 and on a value of said first or second evaluation function
34 calculated in said first or second re-placement evaluation
35 function calculating step; and
36 a mesh point re-placement step of performing re-placement

37 of said mesh points by moving said specified mesh points when said
38 well-posed placement possibility is judged to exist in said
39 well-posed placement possibility judging step.

1 5. A mesh generating method for use in a semiconductor
2 process simulation or a semiconductor device simulation and for
3 achieving an optimum placement of a mesh, comprising:

4 a mesh point initial placement step of placing initially
5 mesh points;

6 an evaluation function calculating step of calculating,
7 values, corresponding to placement patterns, of said first, said
8 second and a third evaluation function each taking on a specified
9 value corresponding to each of placement patterns of said mesh
10 points and each being used as an index for implementing an optimum
11 placement of said mesh points;

12 a first random generating step to generate a first random
13 number;

14 a second random generating step to generate a second random
15 number;

16 a first re-placement evaluation function calculating step
17 of calculating a value of said first evaluation function obtained
18 when each of first specified mesh points is moved in a first
19 probability based on said first random number to a position
20 corresponding to a second random number generated in said second
21 random number generating step;

22 a second re-placement evaluation function calculating step
23 of calculating a value of said second evaluation function obtained
24 when each of second specified mesh points is moved in a second
25 probability based on said first random number to a specified

26 position in a direction in which said second evaluation function
27 becomes an extreme value corresponding to re-placement which
28 brings said mesh points nearly to a state in which an optimum
29 placement is achieved;

30 a third re-placement evaluation function calculating step
31 of calculating a value of said third evaluation function to be
32 obtained when each of third specified mesh points is deleted in
33 a third probability based on said first random number;

34 a well-posed placement possibility judging step of judging
35 said well-posed placement possibility in movement of said first
36 or second specified mesh points based on a value of said first
37 or second evaluation function calculated in said evaluation
38 function calculating step and based on a value of said first or
39 second evaluation function calculated in said first or second
40 re-placement evaluation function calculating step, when said
41 first or second re-placement evaluation function calculating step
42 is performed and of judging said well-posed placement possibility
43 in deletion of said third specified mesh points based on a value
44 of said third evaluation function calculated in said evaluation
45 function calculating step and based on a value of said third
46 evaluation function calculated in said third re-placement
47 evaluation function calculating step, when said third re-
48 placement evaluation function calculating step is performed; and

49 a mesh point re-placement step of performing re-placement
50 of said mesh points by moving or deleting said first, second or
51 third specified mesh points when said well-posed placement
52 possibility is judged to exist in said well-posed placement
53 possibility judging step.

6. The mesh generating method according to Claim 4, wherein said first or second evaluation function is set in advance so that said value of said first or second evaluation function decreases as a placement pattern of said mesh points turns out to be a state of an optimum placement and wherein, in said well-posed placement possibility judging step, said first or second evaluation function calculated in said re-placement evaluation calculating step becomes larger than said first or second evaluation function calculated in said evaluation function calculating step, movement of said specified mesh points in a specified permission probability is judged to be possible and wherein said permission probability is set so that said permission probability decreases with increase in the number of times of re-placement of said mesh points.

7. The mesh generating method according to Claim 6, wherein said first probability is so set that it decreases with increase in the number of times of re-placement of said mesh points.

8. The mesh generating method according to Claim 4, wherein said mesh generating method is employed for use in a simulation of manufacturing processes for semiconductors.

9. The mesh generating method according to Claim 4, wherein, in said second re-placement evaluation function calculating step, a direction in which said first evaluation function or said second evaluation function becomes an extreme value corresponding to re-placement which brings said mesh points

6 nearly to a state in which an optimum placement is achieved, is
7 used as a direction in which same mesh point is moved next time
8 in said second re-placement evaluation function calculating step.

1 10. The mesh generating method according to Claims 4,
2 wherein, in said first and second re-placement evaluation
3 function calculating step, values of said first and second
4 evaluation functions are calculated in a vicinity of said
5 specified mesh points.

1 11. A storage medium storing a mesh generating program
2 to have a computer execute a mesh generating method for use in
3 a semiconductor process simulation or a semiconductor device
4 simulation and for achieving an optimum placement of a mesh,
5 said mesh generating method comprising:

6 a mesh point initial placement step of placing initially
7 mesh points;

8 an evaluation function calculating step of calculating a
9 value, corresponding to a placement pattern, of a specified
10 evaluation function taking on a specified value corresponding to
11 a placement pattern of said mesh points and being used as an index
12 for implementing an optimum placement of said mesh points;

13 a random number generating step of generating random
14 numbers;

15 a re-placement evaluation function calculating step of
16 calculating a value of said evaluation function to be obtained
17 when each of specified mesh points is moved to a position
18 corresponding to said random numbers generated in said random
19 number generating step;

20 a well-posed placement possibility judging step of judging
21 a well-posed placement possibility in movement of said specified
22 mesh points based on a value of said evaluation function
23 calculated in said evaluation function calculating step and on
24 a value of said evaluation function calculated in said re-
25 placement evaluation function calculating step; and
26 a mesh point re-placement step of performing re-placement
27 of said mesh points by moving said specified mesh points when said
28 well-posed placement possibility is judged to exist in said
29 well-posed placement possibility judging step.

1 12. A storage medium storing a mesh generating program
2 to have a computer execute a mesh generating method for use in
3 a semiconductor process simulation or a semiconductor device
4 simulation and for achieving an optimum placement of a mesh,
5 said mesh generating method comprising:
6 a mesh point initial placement step of placing initially
7 mesh points;
8 an evaluation function calculating step of calculating a
9 value, corresponding to a placement pattern, of a specified
10 evaluation function taking on a specified value corresponding to
11 a placement pattern of said mesh points and being used as an index
12 for implementing an optimum placement of said mesh points;
13 a re-placement evaluation function calculating step of
14 calculating a value of said evaluation function obtained when each
15 of specified mesh points is moved to a specified position in a
16 direction in which said evaluation function becomes an extreme
17 value corresponding to re-placement which brings said mesh points
18 nearly to a state in which an optimum placement is achieved;

19 a well-posed placement possibility judging step of judging
20 a well-posed placement possibility in movement in said specified
21 mesh points based on a value of said evaluation function
22 calculated in said evaluation function calculating step and on
23 a value of said evaluation function calculated in said re-
24 placement evaluation function calculating step; and
25 a mesh point re-placement step of performing re-placement
26 of said mesh points by moving said specified mesh points when said
27 well-posed placement possibility is judged to exist in said
28 well-posed placement possibility judging step.

1 13. A storage medium storing a mesh generating program
2 to have a computer execute a mesh generating method for use in
3 a semiconductor process simulation or a semiconductor device
4 simulation and for achieving an optimum placement of a mesh,
5 said mesh generating method comprising:
6 a mesh point initial placement step of placing initially
7 mesh points;
8 an evaluation function calculating step of calculating a
9 value, corresponding to a placement pattern, of a specified
10 evaluation function taking on a specified value corresponding to
11 a placement pattern of said mesh points and being used as an index
12 for implementing an optimum placement of said mesh points;
13 a re-placement evaluation function calculating step of
14 calculating a value of said evaluation function obtained by
15 deleting specified mesh points; and
16 a well-posed placement possibility judging step of judging
17 a well-posed placement possibility in deletion of said specified
18 mesh points based on a value of said evaluation function

19 calculated in said evaluation function calculating step and on
20 a value of said evaluation function calculated in said re-
21 placement evaluation function calculating step; and
22 a mesh point re-placement step of performing re-placement
23 of said mesh points by moving said specified mesh points when said
24 well-posed placement possibility is judged to exist in said
25 well-posed placement possibility judging step.

1 14. A storage medium storing a mesh generating program
2 to have a computer execute a mesh generating method for use in
3 a semiconductor process simulation or a semiconductor device
4 simulation and for achieving an optimum placement of a mesh,
5 said mesh generating method comprising:

6 a mesh point initial placement step of placing initially
7 mesh points;

8 an evaluation function calculating step of calculating a
9 value, corresponding to a placement pattern, of first and second
10 evaluation functions taking on a specified value corresponding
11 to a placement pattern of said mesh points and being used as an
12 index for implementing an optimum placement of said mesh points;

13 a first random generating step to generate a first random
14 number;

15 a second random generating step to generate a second random
16 number;

17 a first re-placement evaluation function calculating step
18 of calculating a value of said first evaluation function obtained
19 when each of specified mesh points is moved in a first probability
20 based on said first random number to a position corresponding to
21 said second random number generated in said second random number

22 generating step;

23 a second re-placement evaluation function calculating step

24 of calculating a value of said second evaluation function obtained

25 when each of said specified mesh points is moved in a second

26 probability based on said first random number to a specified

27 position in a direction in which said second evaluation function

28 becomes an extreme value corresponding to re-placement which

29 brings said mesh points nearly to a state in which an optimum

30 placement is achieved;

31 a well-posed placement possibility judging step of judging

32 a well-posed placement possibility in movement of said specified

33 mesh points based on a value of said first or second evaluation

34 function calculated in said evaluation function calculating step

35 and on a value of said first or second evaluation function

36 calculated in said first or second re-placement evaluation

37 function calculating step; and

38 a mesh point re-placement step of performing re-placement

39 of said mesh points by moving said specified mesh points when said

40 well-posed placement possibility is judged to exist in said

41 well-posed placement possibility judging step.

1 15. A storage medium storing a mesh generating program

2 to have a computer execute a mesh generating method for use in

3 a semiconductor process simulation or a semiconductor device

4 simulation and for achieving an optimum placement of a mesh, said

5 mesh generating method comprising:

6 a mesh point initial placement step of placing initially

7 mesh points;

8 an evaluation function calculating step of calculating,

9 values, corresponding to placement patterns, of said first, said
10 second and a third evaluation function each taking on a specified
11 value corresponding to each of placement patterns of said mesh
12 points and each being used as an index for implementing an optimum
13 placement of said mesh points;
14 a first random generating step to generate a first random
15 number;
16 a second random generating step to generate a second random
17 number;
18 a first re-placement evaluation function calculating step
19 of calculating a value of said first evaluation function obtained
20 when each of first specified mesh points is moved in a first
21 probability based on said first random number to a position
22 corresponding to a second random number generated in said second
23 random number generating step;
24 a second re-placement evaluation function calculating step
25 of calculating a value of said second evaluation function obtained
26 when each of second specified mesh points is moved in a second
27 probability based on said first random number to a specified
28 position in a direction in which said second evaluation function
29 becomes an extreme value corresponding to re-placement which
30 brings said mesh points nearly to a state in which an optimum
31 placement is achieved;
32 a third re-placement evaluation function calculating step
33 of calculating a value of said third evaluation function to be
34 obtained when each of third specified mesh points is deleted in
35 a third probability based on said first random number;
36 a well-posed placement possibility judging step of judging
37 said well-posed placement possibility in movement of said first

38 or second specified mesh points based on a value of said first
39 or second evaluation function calculated in said evaluation
40 function calculating step and based on a value of said first or
41 second evaluation function calculated in said first or second
42 re-placement evaluation function calculating step, when said
43 first or second re-placement evaluation function calculating step
44 is performed and of judging said well-posed placement possibility
45 in deletion of said third specified mesh points based on a value
46 of said third evaluation function calculated in said evaluation
47 function calculating step and based on a value of said third
48 evaluation function calculated in said third re-placement
49 evaluation function calculating step, when said third re-
50 placement evaluation function calculating step is performed; and
51 a mesh point re-placement step of performing re-placement
52 of said mesh points by moving or deleting said first, second or
53 third specified mesh points when said well-posed placement
54 possibility is judged to exist in said well-posed placement
55 possibility judging step.